


## CLAIMS

1. A liquid crystal display comprising an input polarizer, an output polarizer, and a liquid crystal cell in between said input and output polarizers characterized by a twist angle, a cell thickness and a birefringence of the liquid crystal, such that:-

- 5 (a) the liquid crystal has a negative dielectric anisotropy,
- (b) the alignment of the liquid crystal in the zero volt state is substantially vertical and perpendicular to the liquid crystal cell,
- (c) the liquid crystal cell is treated such that there is a pretilt angle of the liquid crystal molecules near the cell surfaces away from the vertical direction, and  
10 thus has a vectorial component on the plane of the liquid crystal cell (the x-y plane),
- (d) the said pretilt angles of the liquid crystal molecules gives rise to a preferred twist angle of value  $\phi$ , where  $\phi$  can be any value, as viewed on the x-y plane,
- (e) the input polarizer angle  $\alpha$  has a value of  $\xi - \phi/2 + N\pi/2$  relative to the tilt  
15 direction of the input director of the said liquid crystal cell on the x-y plane, where  $\xi$  has a value of between  $35^\circ$  and  $55^\circ$  and  $N$  has a value of either  $-1$ ,  $0$  or  $1$ ,
- (f) the output polarizer angle  $\gamma$  has a value of between  $\alpha - 10^\circ$  and  $\alpha + 10^\circ$  on the x-y plane, and
- 20 (g) the product of the cell gap  $d$  and birefringence  $\Delta n$  has a value of between  $1.0$  and  $2.2$  microns.

2. A liquid crystal display comprising an input polarizer, an output polarizer, and a liquid crystal cell in between said input and output polarizers characterized by a twist angle, a cell thickness and a birefringence of the liquid crystal, such that:-

(a) the liquid crystal has a negative dielectric anisotropy, 

(b) the alignment of the liquid crystal in the zero volt state is substantially vertical and perpendicular to the liquid crystal cell,

(c) the liquid crystal cell is treated such that there is a pretilt angle of the liquid crystal molecules near the cell surfaces away from the vertical direction, and thus has a vectorial component on the plane of the liquid crystal cell (the x-y plane),

(d) the said pretilt angles of the liquid crystal molecules gives rise to a preferred twist angle of less than  $45^\circ$  as viewed on the x-y plane,

(e) the input polarizer angle  $\alpha$  is between  $35^\circ$  and  $55^\circ$  relative to the tilt direction of the input director of the said liquid crystal cell on the x-y plane,

(f) the output polarizer angle  $\gamma$  is between  $35^\circ$  and  $55^\circ$  relative to the tilt direction of the input director of the said liquid crystal cell on the x-y plane, and

(g) the product of the cell gap  $d$  and birefringence  $\Delta n$  has a value of between 1.0 and 2.2 microns.

3. A liquid crystal display as claimed in claim 2 wherein the twist angle has a value of between  $-10^\circ$  and  $10^\circ$ .

4. A liquid crystal display comprising an input polarizer, an output polarizer, and a liquid crystal cell in between said input and output polarizers characterized by a twist angle, a cell thickness and a birefringence of the liquid crystal, such that:-

(a) the liquid crystal has a negative dielectric anisotropy,

(b) the alignment of the liquid crystal in the zero volt state is substantially vertical and perpendicular to the liquid crystal cell,

(c) the liquid crystal cell is treated such that there is a pretilt angle of the liquid crystal molecules near the cell surfaces away from the vertical direction, and thus has a vectorial component on the plane of the liquid crystal cell (the x-y plane),

(d) the pretilt angle of the liquid crystal molecules gives rise to a preferred twist angle of larger than  $45^\circ$  as viewed on the x-y plane,

(e) the input polarizer angle  $\alpha$  is between  $-10^\circ$  and  $10^\circ$  relative to the tilt direction of the input director of the said liquid crystal cell on the x-y plane,

(f) the output polarizer angle  $\gamma$  is between  $-10^\circ$  and  $10^\circ$  relative to the tilt direction of the input director of the said liquid crystal cell on the x-y plane, and

(g) the product of the cell gap  $d$  and birefringence  $\Delta n$  has a value of between 1.0 and 2.2 microns.

5. A liquid crystal display as claimed in claim 4 wherein the twist angle has a value of between  $80^\circ$  and  $100^\circ$ .

6. A liquid crystal display comprising an input polarizer, a rear reflector, and a liquid crystal cell in between said input and rear reflector characterized by a twist angle, a cell thickness and a birefringence of the liquid crystal, such that:-

- 5 (a) the liquid crystal used has a negative dielectric anisotropy,
- (b) the alignment of the liquid crystal in the zero volt state is substantially vertical and perpendicular to the liquid crystal cell,
- (c) the liquid crystal cell is treated such that there is a pretilt angle of the liquid crystal molecules near the cell surfaces away from the vertical direction, and
- 10 thus has a vectorial component on the plane of the liquid crystal cell (the x-y plane),
- (d) the pretilt angles of the liquid crystal molecules gives rise to a preferred twist angle of less than  $45^\circ$  as viewed on the x-y plane,
- (e) the input polarizer angle  $\alpha$  is between  $35^\circ$  and  $55^\circ$  relative to the tilt direction .
- 15 of the input director of the said liquid crystal cell on the x-y plane, and
- (f) the product of the cell gap  $d$  and birefringence  $\Delta n$  has a value of between 0.5 and 1.1 micron.

7. A liquid crystal display as claimed in claim 6 wherein the twist angle has a value of

20 between  $-10^\circ$  and  $10^\circ$ .

8. A liquid crystal display comprising an input polarizer, a rear reflector, and a liquid crystal cell in between said input and rear reflector characterized by a twist angle, a cell thickness and a birefringence of the liquid crystal, such that:-

(a) the liquid crystal used has a negative dielectric anisotropy,

(b) the alignment of the liquid crystal in the zero volt state is substantially vertical and perpendicular to the liquid crystal cell,

(c) the liquid crystal cell is treated such that there is a pretilt angle of the liquid crystal molecules near the cell surfaces away from the vertical direction, and thus has a vectorial component on the plane of the liquid crystal cell (the x-y plane),

(d) the pretilt angles of the liquid crystal molecules gives rise to a preferred twist angle of larger than  $45^\circ$  as viewed on the x-y plane,

(e) the input polarizer angle  $\alpha$  is between  $-10^\circ$  and  $10^\circ$  relative to the tilt direction of the input director of the said liquid crystal cell on the x-y plane, and

(f) the product of the cell gap  $d$  and birefringence  $\Delta n$  has a value of between 0.5 and 1.1 microns.

9. A liquid crystal display as claimed in claim 8 wherein the twist angle has a value of between  $80^\circ$  and  $100^\circ$ .